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## **Spacecraft Charging Current Balance Model Applied to High Voltage Solar Array Operations**

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Spacecraft charging induced by high voltage solar arrays can result in power losses and degradation of spacecraft surfaces. In some cases, it can even present safety issues for astronauts performing extravehicular activities. An understanding of the dominant processes contributing to spacecraft charging induced by solar arrays is important to current space missions, such as the International Space Station, and to any future space missions that may employ high voltage solar arrays. A common method of analyzing the factors contributing to spacecraft charging is the current balance model. Current balance models are based on the simple idea that the spacecraft will float to a potential such that the current collecting to the surfaces equals the current lost from the surfaces. However, when solar arrays are involved, these currents are dependent on so many factors that the equation becomes quite complicated. In order for a current balance model to be applied to solar array operations, it must incorporate the time dependent nature of the charging of dielectric surfaces in the vicinity of conductors<sup>1-3</sup>. This poster will present the factors which must be considered when developing a current balance model for high voltage solar array operations and will compare results of a current balance model with data from the Floating Potential Measurement Unit<sup>4</sup> on board the International Space Station.

### References:

<sup>1</sup>D. C. Ferguson, P. D. Craven, J. Minow, and K. Wright, "A theory for rapid charging events on the International Space Station," in AIAA Atmospheric and Space Environments Conference, 2009.

<sup>2</sup>J. Huang, Z. Yi, H. Zhao, L. Meng, and Y. Liu, "Model for rapid-charging events for the International Space Station," *Journal of Spacecraft and Rockets*, vol. 51, no. 1, pp. 11-15, 2014.

<sup>3</sup>J. Huang, Z. Yi, H. Zhao, L. Meng, and Y. Liu, "Mechanism for rapid charging events on International Space Station," *Journal of Spacecraft and Rockets*, vol. 51, no. 3, pp. 917-921, 2014.

<sup>4</sup>K. H. Wright Jr, C. M. Swenson, D. C. Thompson, A. Barjatya, S. L. Koontz, T. A. Schneider, J. A. Vaughn, J. I. Minow, P. D. Craven, V. N. Coffey, et al., "Charging of the International Space Station as observed by the floating potential measurement unit: Initial results," *Plasma Science, IEEE Transactions on*, vol. 36, no. 5, pp. 2280-2293, 2008.

